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PLANETARY RESEARCH CENTER
LOWELL OBSERVATORY
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FINAL REPORT
for
NASA GRANT NGR-03-003-001

"PLANETARY RESEARCH AT LOWELL OBSERVATORY"

1 JULY 1969 — 31 MAY 1990

31 MAY 1990

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HISTORY

This document is the *Final Report* for NGR-03-003-001. It will also serve as *Status Report 52/53* covering CY1989. Over the past 21 years; NGR-03-003-001 has enabled the Lowell Observatory to do productive and timely research in a broad range of planetary projects.

Actually, NASA has supported planetary research at the Lowell Observatory since 1963, and it also aided construction of the Planetary Research Center at Lowell in 1965. From 1 July 1963 to 30 June 1969, research was funded under NsG-451. Starting 1 July 1969, research support has been provided by NGR-03-003-001, and by several single-purpose grants spawned from it in the late 1970s. Another grant, NGR-03-003-007, covered the supplemental costs from 1968 to 1976 for our operation of an international network of planetary patrol telescopes.

The scientific staff of the Planetary Research Center was recruited over an extended time period, starting with William A. Baum (the PI) in 1965 and Robert L. Millis in 1967. Those two were joined in the 1970s by Peter B. Boyce, Edward L. G. Bowell, Lawrence H. Wasserman, and Barry L. Lutz. All except Boyce (now the Executive Officer of the AAS) are still with the Center. Tobias J. Kreidl and David G. Schleicher came on board in the 1980s. Other Lowell astronomers participating in Center projects have included John S. Hall, Otto G. Franz, and G. Wesley Lockwood. Many support staff also contributed substantially to work under this grant; we particularly mention S. E. Jones, H. S. Horstman, L. J. Martin, D. T. Thompson, C. F. Capen, and J. L. Inge.

ACCOMPLISHMENTS

Our initial task in the 1960s was to collect or copy historical planetary photographs from observatories around the world and organize them into a cataloged archive suitable for systematic study of time variable phenomena. The principal sources were Lowell (the world's largest collection), Lick (second largest), Mount Wilson, New Mexico State, Meudon (France), and Table Mountain. We then established a globe-girdling network of seven stations with identical automated film cameras on dedicated 0.6-meter telescopes to obtain 24-hour synoptic coverage of Mars and Jupiter for several months bracketing their respective apparitions starting in 1969. During the first seven years of intensive operation, the network produced more than 100,000 film strips with more than a million images of usable quality. This activity was concurrent with the Mariner 9 mission to Mars, and early analysis of our groundbased films yielded useful global data on dust storms and albedo features. Operation of the patrol network was continued at a reduced level throughout the Viking mission to Mars, in which several of our staff were participants. In addition to our own staff, a number of guest investigators (listed regularly in our status reports) used the Planetary Center collection.

During the 1970s, work under NGR-03-003-001 expanded to include photoelectric photometry, photoelectric spectrum scanning, echelle spectroscopy, CCD imaging, and computer image processing. Those techniques were applied to studies of asteroids, comets, planetary rings, planetary satellites, and outer planet atmospheres. The systematic analysis of planetary photographs (both Mars and Jupiter) and the publication of results was continued. Findings during the 1970s pertained to the properties of Martian dust clouds and dust storms, the behavior of Martian polar caps and hoodes, secular changes of albedo features on the Martian surface, differential motions in the Jovian atmosphere, the taxonomy of asteroids, line strengths in outer planet atmospheres, the dimensions and shapes of asteroids that occulted stars, and the co-discovery of the rings of Uranus. Techniques for the detection of extra-solar planets were explored.

Separate grants were created in the late 1970s to continue some of the main projects started under NGR-03-003-001. Those included studies of asteroids (Bowell), outer planet spectroscopy (Lutz), and the occultations of stars by Solar System bodies (Millis).

During the 1980s, work under NGR-03-003-001 particularly emphasized studies of the Saturn ring system, narrowband photometry of a very large number of comets, and the CCD imaging of cometary comae. Findings during the 1980s included discovery of the quadrant brightness asymmetry of Saturn's A ring, the distribution of particles in Saturn's elusive E ring, the thickness of Saturn's F ring, rotation and phase curves for Saturn satellites, abundance ratios in comets, spatial distributions of cometary emissions, the rotations of cometary nuclei, and the fading (volatilization?) of outflowing cometary grains. Techniques of searching for trans-Neptunian comets were explored.

PUBLICATIONS

The following publications reported work supported, at least in part, by this grant. Among the authors and co-authors of these papers, those associated with NGR-03-003-001 included (alphabetically) William A. Baum, Edward L. G. Bowell, Peter B. Boyce, John Caldwell, Charles F. Capen, Gordon E. Fischbacher, Otto G. Franz, Jay L. Inge, Stuart E. Jones, Tobias J. Kreidl, Barry L. Lutz, Leonard J. Martin, Robert L. Millis, David G. Schleicher, Don T. Thompson, and Lawrence H. Wasserman.

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